framework; so that by "Diagrams of Forces" the conditions of stability of loaded structures, and the form and tensions of suspension bridges, could at once be determined, by measurement of these diagrams or by calculation from them. Of the variety of text-books on the subject of mechanics, the teacher should reject books that profess to be adapted for examinations, as well as those which contain gross errors on the laws of friction, or on the inertia of matter and the laws of motion, or on the subject of dynamical units and should select from those which are not liable to such objections.

Competitive examinations may be useful if they are made tests of thorough knowledge; but too often they injure the student who is preparing for them by narrowing his mind, and create a class of dabblers in science, and are worthless for the purpose for which they are intended. Test examinations given to a class on the subject of their lectures are the best tests of the knowledge and progress of the student.

In teaching the laws of equilibrium of liquids and of gases, the same method must be followed as in teaching the laws of equilibrium and of motion of solids; and in addition to lectures and ordinary teaching students should have the opportunity of making experiments and measurements in these subjects in a physical laboratory. Some knowledge of other kindred sciences is necessary before a student can be said to have an intelligent knowledge of the principles of mechanical science. Accurate investigation and experiment show that near the melting and the boiling points the special properties and laws of solids or of liquids are no longer true, and Dr. Andrews has pointed out the existence of a border-land between the liquid and the gaseous states, and has shown that there is no breach of continuity between them. Taking a model, of which three rectangular edges shall represent the pressure, volume, and temperature, the upper surface will represent the state of the substance, and will explain in what way it is possible to pass from the liquid to the gas without change of state or any sudden change of volume. The ease with which we can conceive of the state of a gas under different circumstances, when we have such a model before us, shows the importance of employing figures and models to give a boy clear ideas of the propositions of mechanics.

Regarding Mechanics in its wider sense as the Science of Energy, there are three great principles—the Conservation, the Transformation, and the Dissipation of Energy, which have been established, and these principles are illustrated in the conversion of water into steam, in winding up a watch, in the diffusion of gases, in the conduction of heat, in the friction of the tides on the earth, and in the rushing of water down a mountain side. This latter source of energy has been employed in piercing the Mont Cenis tunnel.

The accuracy of the calculations by which the axes of the two tunnels on opposite sides agreed so completely with one another shows the importance of accurate measurement, and of the correct application of theoretical principles to practice.

These principles of energy tell us that in raising the waters of the ocean to the mountain tops, as much energy must be expended as can be expended by those waters in their return to the ocean, and the atmosphere, acted upon by the solar heat, is the vast air-engine by which these changes are accomplished.

NOTES

AT the last meeting of the Royal Society the names of the candidates for election into the Society were read, in accordance with the statutes, as follows:—Andrew Leith Adams, Surgeon-Major; William Grylls Adams, M.A.; William Aitken, M.D.; Sir Alexander Armstrong, K.C.B., M.D.; Edward Middleton Barry, R.A.; John Beddoe, B.A., M.D.; Henry Bowman Brady, F.L.S.; Frederick Joseph Bramwell, C.E.; James Brunlees, C.E.; Edwin Kilwick Calver, Capt. R.N.; Alexander Carte, M.A., M.D.; William Chimmo, Commander R.N.; Prof. Arthur Herbert Church, M.A.; Fredk. Le Gros Clark, M.R.C.S.; Prof. John Cleland, M.D.; Herbert Davies, M.D.; Henry Dircks, F.C.S.; August Dupré, Ph.D.; Michael Foster, jun., M.A., M.D.; Peter Le Neve Foster, M.A.; Wilson Fox, M.D.; Arthur Gamgee, M.D.; Prof. Thomas Minchin Goodeve, M.A.; Townshend M. Hall, F.G.S.; Edmund Thomas Higgins, M.R.C.S.; Rev. Thomas Hincks, B.A.; Rev. A. Hume, LL.D.; Henry Hyde, Lieut.-Col. R.E.; Prof. William Stanley Jevons, M.A.; Edmund Charles Johnson, F.R.G.S.; George Johnson, M.D.; Prof. Thomas Rupert Jones; John Leckenby, F.G.S.; Clements R. Markham, Sec. Geog. Soc.; William Mayes, Staff-Comm. R.N.; Edmund James Mills, D.Sc.; Thomas George Montgomerie, Major R.E.; Robert Stirling Newall, F.R.A.S.; Edward Latham Ormerod, M.D.; Francis Polkinghorne Pascoe, F.L.S.; Prof. Oliver Pemberton; Rev. Stephen Joseph Perry; John Arthur Phillips, F.C.S.; Bedford Clapperton T. Pim, Captain R.N.; William Overend Priestley, M.D.; Charles Bland Radcliffe, M.D.; Edward John Routh, M.A.; George West Royston-Pigott, M.D.; William Westcott Rundell; William James Russell, Ph.D.; Osbert Salvin, M.A.; Harry Govier Seeley, F.L.S.; Alfred R. C. Selwyn (Geol. Survey, Canada); Peter Squire, F.L.S.; George James Symons, V.P. Met. Soc.; Edwin T. Truman, M.R.C.S.; Wildman Whitehouse, C.E.; Henry Woodward, F.G.S.; Archibald Henry Plantagenet Stuart Wortley, Lieut-Col.

THE EARL OF LONSDALE, whose death is recorded this week, was the father of the Royal Society, his election having taken place sixty-two years ago, in 1810. This honour now devolves on Sir Henry Holland, elected in 1815.

THE death is announced, on the 3rd inst., of Dr. A. B. Granville, F.R.S., at the age of 88. He was one of the oldest Fellows of the Royal Society, having been elected in 1817, and was member of a large number of foreign learned societies.

WE are very glad to be able to state that intelligence has just been received from Prof. Huxley that his health has already been greatly renovated by the pure air of Upper Egypt. He wrote from Thebes, and was then contemplating a visit to Assouan, from which he would probably have returned to Thebes before this.

SIR WILLIAM THOMSON has accepted the office of President of the Geological Society of Glasgow.

THE Radcliffe Travelling Fellowship at Oxford has been awarded to Mr. F. H. Champneys, B.A. of Brasenose College. This Fellowship is of the annual value of 200*l.*, and tenable for three years, provided the Fellow does not spend more than eighteen months within the United Kingdom.

THE President of the Quekett Microscopical Club will hold a *soirée*, on Friday evening, March 15, at University College.

DR. LIEBREICH, the eminent ophthalmist, of St. Thomas's Hospital, delivered a lecture at the Royal Institution on Friday evening last, on certain faults of vision, with special reference to Turner and Mulready. The later "aberrations" of Turner's style he attributed to a physical change in the refractive power of the eye, by which illuminated points were converted into illuminated lines. The change of manner in Mulready's later pictures he accounted for, in like manner, by increasing yellow degeneration of the crystalline lens. We hope in a future number to give a report of the lecture.

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THE Royal Academy of Sciences of Belgium offers prizes on the following subjects for Essays to be sent in during the year 1873 :—(1) A simplification of the theory of the integration of equations of the two first orders ; (2) On the disturbing causes which influence the determination of the electro-motor force and of the interior resistance of an element of the electric pile ; (3) On the relations of heat to the development of flowering plants, especially with regard to the periodic phenomena of vegetation, and on the dynamical influence of solar heat on the evolution of plants ; (4) On the mode of reproduction of serpents ; (5) On the composition and mutual relations of albuminoid substances ; (6) On the coal fields of the basin of Liége. A gold medal of the value of 1000 fr. will be given for the first, fifth, and sixth questions, and of 600 fr. for the second, third, and fourth. The essays must be written in Latin, French, or Flemish. For 1874 the subjects are :—(1) On uric acid and its derivatives, especially in relation to their chemical structure and synthesis ; (2) On the polymorphism of the Mucedineæ, their real nature, and the conditions of their development ; (3) On the question whether the fungi of fermentation can, under certain circumstances, become changed into the higher fungi, with positive proof of the fact or the contrary.

Harper's Weekly states that Uriah F. Boyden, of Boston, U.S.A., has deposited with the Franklin Institute, of Philadelphia, the sum of one thousand dollars, to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity. The conditions of the premium limit the applicants to those living north of the southern boundary of Mexico, and including the West India Islands. Applications must be made before the 1st of January, 1873, at which time the judges, appointed by the Franklin Institute, shall examine the memoirs and decide whether any one is entitled to the premium.

WE are desired by Colonel Grant to say that the botanica collection from Tropical Africa, referred to at p. 339, was not made in conjunction with Captain Burton, but during the journey of Captain Speke and himself in 1860-3, from Zanzibar to the great central Lake Region. The results will shortly be published in the Transactions of the Linnean Society; it will be illustrated by 100 (not 600) 4to plates, and the descriptions will be in great part drawn up by Prof. Oliver. We are glad to hear that Mr. W. O. Livingstone, who is accompanying the Livingstone Search Expedition, has considerable botanical knowledge, and is intending to bring home a collection.

IN reference to the hairy tapir of the South American Andes (*Tapirus Roulini*), the acquisition of skeletons of which by the Smithsonian Institution was spoken of in our last number (p. 370), we are informed that a fine series of skins and skeletons of the animal has recently been obtained by Mr. Buckley in Ecuador. Some of these are now in the British Museum ; the others have been purchased by Mr. Edwd. Gerrard, jun., of Camden Town. At the last meeting of the Zoological Society a paper was read by Dr. Gray, describing the specimens acquired by the British Museum, and referring them to a new species, *Tapirus leucogenys*. But we are informed that there are no valid grounds for separating them from Roulin's Tapir of the U.S. of Colombia.

WE desire to call attention to the Annual General Meeting of the Iron and Steel Institute, which will be held in Willis's Rooms, King Street, St. James's, London, commencing on Tuesday, March 19, under the presidency of Mr. Henry Bessemer. The programme of proceedings will be found in our advertising columns. It is expected that on Tuesday evening, March 19, a paper, by Mr. I. Lowthian Bell, "On the Conditions which Favour and those which Limit the Economy of Fuel in the Blast Furnace for Smelting Iron," will be read and discussed at the meeting of the Institute of Civil Engineers, Great George Street, Westminster. The Council have kindly promised to issue invitations to members of the Iron and Steel Institute, to attend on this occasion.

OUR readers will have noticed in our advertising columns the list of subscriptions at present received to the "Priestley Memorial Fund." The object is worthy of the attention of all who are able and disposed to assist in so meritorious an object.

AN important letter, by M. Berthelot, appears in the *Moniteur Scientifique* for February, in which this eminent *savant* insists on the reconciliation of the scientific worlds of France and Germany, pointing out that the united action of France, Germany, and England, in the advancement of civilisation and science, is necessary for the progress of the world.

IT is stated that shocks of earthquake were felt at Dresden, Pirna, Schandau, Chemnitz, Rodenbach, Weimar, and Rudolstadt, between three and four o'clock on the afternoon of the 6th inst. They continued to recur during an hour, and in some cases several hours.

THE return of Professor C. F. Hartt, of Ithaca, from his late expedition to Brazil, has been already announced in the papers ; and we are glad to learn, from *Harper's Weekly*, that he succeeded in making many important discoveries in natural history and the geography of the country, and especially the languages of the native tribes. By his researches in this latter direction he has already become quite an authority, and, we presume, will before long begin to publish his linguistic results. In the course of his expedition Professor Hartt took occasion to examine the great Kjoekkenmoedding, near Santarem, referred to by various travellers, which, however, yielded him only a few fragments of coarse pottery and a few bones. He was very fortunate in the opportunity of excavating the sites of a number of Indian villages on the edge of the bluffs bordering the Amazon and the Tapajos, in the angle made by the two rivers. Here he found an immense quantity of broken pottery, often highly ornamented, idols, stone implements, &c., probably derived from the Tapajos, now extinct as a tribe, or merged into the mixed Indian population of the Amazon. In an ancient burial-place on the Tapajos he dug up a number of burial-pots ; none, however, containing complete skeletons. An examination of the mounds of the island of Marajo was to be made by some of his associates who remained behind.

THE Royal Horticultural Society has just issued an exceedingly comprehensive and valuable series of meteorological observations made at their gardens at Chiswick from 1826 to 1864, and analysed by Mr. James Glaisher. The number of tables is nearly sixty, including the mean temperature of every day, and the extremes of mean temperature for every day in each month during the year specified, the excess or deficiency above or below the average of the mean temperature of every day, month, and year ; the daily ranges of temperature on every day of the year, and the daily falls of rain in each month. Comparisons are made with the series of observations taken at Greenwich ; general conclusions are deduced, and the introductory observations are of value and interest to all meteorologists.

WE understand that the Meteorological Committee have resolved to issue lithographed illustrative charts of the Daily Weather Report, which will be delivered in London, within a reasonable distance from the office of the printer in Lincoln's Inn Fields, between 1 and 2 P.M., or posted in time for the evening mails. Up to the 31st of March these charts will be supplied gratuitously.

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